Enabling Interorganizational System Integration: The Compromise Perspective

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ENABLING INTERORGANIZATIONAL SYSTEM INTEGRATION: THE COMPROMISE PERSPECTIVE

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Abstract

Firms have been increasingly using inter-organizational systems (IOS) to enhance transaction efficiency. IOS integration thus has become critical in facilitating tighter integration between trading partners. Firms, however, still face various difficulties that impede the implementation of IOS integration, such as potential adversarial behaviors and conflicts. Thus, exploring how to effectively promote IOS integration is significant for both theory development and practice. This study applies the concept of compromise and develops interfirm process compromise and technology compromise based on the relational view. These two compromise constructs, as relational preconditions, are proposed to affect the achievement of better IOS integration. The results of this study support the hypothesized direct effect of technology compromise on IOS integration based on 44 matched-pair samples gathered from the top 1000 Taiwanese manufacturing firms. We also propose and show the indirect effect of interfirm process compromise on IOS integration, mediated by technology compromise. Our results provide the theoretical and practical implications that contribute a better understanding of the role of compromises in developing IOS integration. The model and findings of this study should be able to serve as a basis for future research in examining IOS integration.

Keywords: inter-organizational system integration, compromise, relational view, supply chains.
1 INTRODUCTION

Over the past decades, firms have applied inter-organizational systems (IOS) to improve transaction efficiency and cooperative relationships with their trading partners in the supply chain (Grover & Saeed, 2007; Rai & Tang, 2010; Subramani, 2004). Practitioners and researchers have increasingly believed that effective use of IOS can create significant value for partners. Many firms, thus, attempt to establish deep interconnections with the systems of their partners to practice seamless sharing of information and interconnection of applications (Barua, Konana, Whinston, & Yin, 2004; Grover & Saeed, 2007). This form of tightly coupled trading partnership has been referred to as IOS, IT, or IS integration (Grover & Saeed, 2007; Rai, Patnayakuni, & Patnayakuni, 2006; Rai & Tang, 2010; Saraf, Langdon, & Gosain, 2007). By achieving high levels of IOS integration, firms can gain a number of benefits, such as improved collaboration, information sharing, buyer-supplier relationships and performance (Rai et al., 2006; Ramamurthy, Premkumar, & Crum, 1999; Saraf et al., 2007). Thus, how to promote IOS integration is a critical issue in contemporary supply chain management.

Although IOS implementation is not a new research topic, most prior studies, however, focused primarily on IOS adoption rather than on IOS integration. The predominant theories for explaining IOS adoption and integration include innovation diffusion theory, transaction cost economics, information processing theory, and resource dependency theory. Based on these theories, various contextual factors, such as environment, technology, organization and interfim relationship, have been proposed to affect IOS implementation. Most of these factors, however, have been shown to be determinants of IOS adoption but fail to facilitate IOS integration (Narayanan, Maruchek, & Handfield, 2009). The reason is that IOS integration requires firms make significant investments with high relational specificity. Even though most firms have implemented some basic interconnection between systems of trading partners and simple automated data exchange, the level of IOS integration, however, remains to be low (Chatfield & Yetton, 2000). IOS integration needs to connect not only technology but also social ties and economic actions. Such complicated activities involved can hinder the process of IOS implementation.

In fact, implementing IOS integration is not a simple matter. IOS integration requires dyadic firms to align not only technology standards but also intra and interfim processes (Grover & Saeed, 2007). To achieve this, firms typically will face a variety of difficulties, such as adversarial behaviours and conflicting practices (Kumar & van Dissel, 1996), requiring partners to negotiate over various issues related to the processes and technologies. These problems implicate changes to a wide range of extant practices entrenched in individual firms (Kambil & Short, 1994; Kumar & van Dissel, 1996; Redondo, Daniel, & Ward, 2009; Rodon & Sese, 2010; Venkatraman, 1994). These practices reflect firms’ cultures, beliefs, interests, and values (Rodon & Sese, 2010). Interfirm conflicts thus frequently result in a low level of IOS use because lack of an initial structure contributes to the inconsistent decisions made across trading partners (Kumar & van Dissel, 1996). These conflicts need to be resolved by a series of negotiations in order to find compromise resolutions that can serve as a well-built precondition for shaping IOS integration (Lu, Huang, & Heng, 2006).

Compromise, a needed condition for IOS integration, is defined as mutually acceptable settlements between two firms to make reciprocal concessions in order to resolve the conflicts. Past studies have indicated that if firms fail to pay sufficient attention to resolving conflicts and to establishing a compromise precondition, they may achieve only lower-level use of or break up the implementation of IOS integration (Kauremaa, Nurmiilaakso, & Tanskanen, 2010). Yet, missing from prior studies is a deep analysis of existing conflicting processes and technology problems, compromise resolutions, and how the resolutions shape IOS integration. This may lead firms and managers to form the mistaken belief that IOS adoption will automatically bring about IOS integration, better coordination, and ultimately higher performance. Thus, our research focuses on (1) identifying interfim process compromises and technology compromises as the two critical relational preconditions of IOS integration, and (2) examining how the two compromises affect IOS integration. We draw upon the relational view to inform our investigation, followed by theoretically developing a research model, which suggests that these compromises can provide a well-built precondition for shaping IOS.
integration. This study focuses on the dyadic relationships in the supply chain, and the results of the study should contribute to an emerging theory that provides both theoretical and practical implications for managing supply chains in general and developing IOS integration in specific.

2 IOS BACKGROUND LITERATURE

2.1 From IOS adoption to integration

With the rapid development of IT, IOS have been widely adopted to support transactions between firms. The use of IOS has been found to provide both operational and strategic benefits to firms (Chwelos, Benbasat, & Dexter, 2001; Subramani, 2004). However, if an IOS fails to integrate the key intra and interfirm IS applications and work processes, the IOS will only result in door-to-door data exchange (Chatfield & Yetton, 2000). Though being called IOS adoption (Iacovou, Benbasat, & Dexter, 1995), the benefits that firms can realize from using IOS will be minimal. Robey’s (2008) review and Narayanan’s (2009) meta-analysis have shown that we have gained significant knowledge regarding the factors influencing IOS adoption. Consequently, researchers have turned their attention to IOS integration. IOS integration refers to a specific configuration of IOS use that reflects tighter linkages between trading partners’ information systems and has been identified as a key driver of business value (Barua et al., 2004; Rai et al., 2006). IOS integration typically consists of a higher level of functional application integration and a lower level of technology stack integration (Barua et al., 2007). IOS integration also reflects close linkages of social ties and economic actions between partners (Chatfield & Yetton, 2000). IOS integration can support bilateral governance (Grover & Saeed, 2007) and require trading partners mutually configure the details of IOS to make it suitable for each party. In this study, we define IOS integration as the extent to which a focal firm’s information systems are closely linked with its trading partner’s information systems as a unified whole to facilitate bidirectional information access and sharing (Grover & Saeed, 2007; Saraf et al., 2007).

2.2 The determinants of IOS adoption and integration

Although adoption and integration are two distinct stages in the overall implementation cycle, early studies attempt to find common factors that influence both stages (Narayanan et al., 2009; Robey et al., 2008). Researchers have identified a variety of determinants of IOS adoption and integration. These determinants can be categorized into environmental, technological, organizational and relational factors. For environmental factors, most studies are based on information processing theory (Galbraith, 1973) and propose that firms need appropriate information capabilities to cope with information processing needs (Kim, Umanath, & Kim, 2005-6; Premkumar, Ramamurthy, & Saunders, 2005). Various kinds of IOS, such as EDI (Bensaou & Venkatraman, 1995), electronic information transfer (Kim et al., 2005-6) and IOS integration (Grover & Saeed, 2007), have been proposed to cope with various uncertainties caused by technology, demand, supply, and partner behaviours (Chang, Wang, & Chiu, 2008; Grover & Saeed, 2007; Premkumar et al., 2005). Studies based on transaction cost theory also suggest that firms need to choose an appropriate governance form, such as virtual integration (Wang, Tai, & Wei, 2006) and IOS integration (Grover & Saeed, 2007), to deal with uncertainties. Another environmental perspective is based on institution theory, which holds that external pressures can lead firms to greater IOS adoption intention (Bala & Venkatesh, 2007; Chwelos et al., 2001; Teo, Wei, & Benbasat, 2003).

For technology characteristics, studies are largely based on innovation diffusion theory (Rogers, 1995). IOS is defined as an innovation diffusing among internal departments and external trading partners through the multiple stages of IOS diffusion process from adoption, implementation, to assimilation (Wu & Chuang, 2010). Five key innovation attributes of IOS, including relative advantage, compatibility, complexity, costs, and communicability, are proposed to influence adoption and internal and external diffusion (Premkumar, Ramamurthy, & Nilakanta, 1994; Ramamurthy et al., 1999; Wu & Chuang, 2010). Although much knowledge on how technology characteristics would promote IOS adoption and diffusion has been uncovered, prior studies largely ignore that many
implementation difficulties have to be tackled from adoption to assimilation rather than focusing on a single stage.

Organizational features also play an important role in promoting IOS adoption and integration. Early studies have proposed that organizational readiness can lead to a well-built precondition for EDI adoption (Chwelos et al., 2001; Iacovou et al., 1995). Organizational inertia theory suggests that resource and routine rigidities inhibit the assimilation of IOS (Bala & Venkatesh, 2007). Resource and routine rigidities constrain a firm’s ability to change its resource investment patterns and organizational processes. These theories indicate that the assimilation of IOS requires changes of extant resources and routines. They, however, neglect to examine what kind of changed results would promote the assimilation.

Finally, relational antecedents have been proposed from various theoretical perspectives. These relational antecedents only emerge from a specific relationship of dyadic firms. Based on transaction cost economics (TCE), transaction-specific assets and reciprocal investments are demonstrated to be able to promote electronic integration and EDI use (Son, Narasimhan, & Riggins, 2005; Zaheer & Venkatraman, 1994). With resource dependence theory (RDT), Hart and Saunders (1997) propose that power will influence EDI adoption, but not supported by their empirical results (Hart & Saunders, 1998). Iskandar et al. (2001) attempt to demonstrate that dependence, frequency of transactions, and relationship promote EDI adoption and integration. Unfortunately, most determinants they proposed, though significantly influencing EDI adoption, fail to facilitate EDI integration. From the relational view, that firms are willing to share information with their trading partners can facilitate IOS integration (Grover & Saeed, 2007). Other factors, such as trust, commitment, and long-term orientation, have also been identified to affect IOS integration (Ibrahim & Ribbers, 2009; Patnayakuni, Rai, & Seth, 2006; Zaheer & Venkatraman, 1994). Overall, prior studies suggest that relational antecedents play critical roles in implementing IOS integration.

2.3 Knowledge gap in the field of IOS integration

All the above studies contribute to our knowledge of IOS adoption and integration. These studies have advanced our knowledge of the contextual factors that produce the needs for IOS integration and motivate its implementation. However, according to innovation diffusion theory, implementing IOS would go through multiple stages of the diffusion process. Before achieving a high degree of IOS integration by reaching the assimilation stage, firms inevitably face a variety of operational-level difficulties caused by divergent processes and technologies resided in the partner firms (Kambil & Short, 1994; Kauremaa et al., 2010; Rodon & Sese, 2010; Venkatraman, 1994). These processes and technologies that reflect their extant interests, values, and practice are difficult to change (Howcroft, Mitev, & Wilson, 2004; Rodon & Sese, 2010). These divergent processes and technologies are in fact social structures enacted in the firms (Giddens, 1984). Contradictions or inconsistencies in the social structures between firms may emerge (Rodon & Sese, 2010) and hinder IOS integration, as such contradictions are likely to cause a series of conflicts during integration. The reason is that IOS integration is a tightly coupled system consisted of interdependent elements; this means that any inconsistency in one element of the social structure may require adjustments in other elements (Orton & Weick, 1990). In order to achieve IOS integration, firms have to transform the social structure in the interfirm context by changing their original technologies, such as the syntax and semantics of data, and processes (Rodon & Sese, 2010). If firms fail to resolve these problems, they are likely to encounter severe obstacles during the implementation of IOS integration (Kauremaa et al., 2010), resulting in low levels of integration or IOS use merely in a perfunctory manner. When managers misunderstand and ignore the conflicts between social structures, IOS integration may fail. Therefore, the contextual factors that promote firms to implement IOS integration would be offset by the forces of persistence when firms are unwilling to make concessions or continue with extant practices. Firms, thus, need to negotiate with each other to overcome the conflicts and to reach mutually acceptable settlements, i.e., that they need to compromise, for performing a series of needed, coordinated adjustments, thereby enabling IOS integration (Lu et al., 2006). Unfortunately, past studies neglect these potential conflicts in the social structures of the firms – process and technology – that inhibit IOS integration (Kauremaa et al., 2010; Rodon & Sese, 2010) and fail to see compromises as key
facilitators of IOS integration. We, consequently, attempt to develop the concept of compromise to go beyond those traditional discourses in explaining IOS integration.

3 THEORETICAL FOUNDATION FOR COMPROMISE

Compromise is a prevalent phenomenon in conflict resolution and has been discussed in such fields as negotiation and philosophy. We develop the compromise perspective from the fields of negotiation and philosophy because the negotiation field, focusing on negotiation of dyadic parties, is more suitable for analyzing dyadic buyer-supplier relationships and the perspective of philosophy helps clarifying the nature of compromise. Our conceptualization of compromise focuses on the outcomes of compromise rather than on the planning or intention of adopting a compromise strategy. Therefore, we define compromise as the extent to which dyadic firms realize a mutually acceptable settlement on a set of conflict issues in which each firm makes reciprocal concessions based on its initial position (Ganesan, 1993; Van de Vliert & Hordijk, 1989). Further, based on the relational view, we argue that compromised outcomes are a type of relationship-specific intangible assets as well as informal self-enforcing agreements.

3.1 Compromise from the perspective of negotiation

Negotiations are interactions among heterogeneous firms for finding a suitable set of conflict resolutions. During negotiation, there are a multitude of elements that can influence the interactions and lead to resolution (Bijker, 1997). These elements may include the problems to be settled, organizational constraints, attributes of extant computer-based systems, and negotiation strategies (Howcroft et al., 2004). So if interactions move the firms toward the same direction, a mutually acceptable resolution is more likely be reached, leading to good results (Howcroft et al., 2004). Interfirm process and technology problems are typically involved and have to be tackled when implementing IOS integration (Grover & Saeed, 2007; Kauremaa et al., 2010; Kumar & van Dissel, 1996; Lu et al., 2006; Rodon & Sese, 2010; Venkatraman, 1994). Processes and technology configurations very often reflect a firm’s value and culture, which are difficult to change (Bala & Venkatesh, 2007; Puschmann & Alt, 2005). IOS integration as technological development is a multidirectional and non-linear process that involves constant negotiations and renegotiations on extant interfirm processes and technology configurations in order to find mutually acceptable settlements, making compromise critical for implementing IOS integration.

From the perspective of negotiation strategy, compromise is one of the conflict handling strategies. Traditionally, five negotiation strategies have been proposed to handle conflicts: aggressive, problem solving, compromising, avoiding, and accommodating (Blake & Mouton, 1970; Thomas, 1976). Ganesan (1993) indicates that strategies of problem solving, compromise, and aggressive are conducted mainly to deal with conflicts and to find resolutions in buyer-supplier relationships. During negotiation, dyadic firms tend to hold their minimum requirements and interests (Sebenius, 1992). These are major barriers that constrain the boundaries of available option spaces of interfirm processes and technology configurations. The firms then attempt to negotiate and renegotiate a mutually acceptable resolution from available options. Under such circumstances, resolution from problem solving strategy, needing to satisfy both parties (Dant & Schu, 1992), is difficult to reach, and resolution from aggressive strategy, attempting to resolve through the use of threats (Ganesan, 1993) and implying the exercise of power, has been shown to negatively affect deeper EDI usage (Hart & Saunders, 1998). Compromise, involving both parties to give up something in order to make a mutually acceptable decision possibly by splitting the difference, exchanging concessions, middle-ground positioning, or satisfying both parties’ interests (Rahim, 2010), should be a reasonable strategy to take for resolving interfirm processes and technology problems. In fact, an interfirm process or a technology resolution implicates a host of conflict activities and technology configurations between firms. Interfirm process and technology problems cannot be tackled one by one. A comprehensive resolution is needed to resolve conflicts in process or technology. Such complication increases the difficulties of conducting a problem solving strategy to find a perfect resolution on a set of issues.
Therefore, we argue the outcomes of compromise are more like to realize than those of problem solving and aggressive strategies in the interfirm, supply chain setting.

### 3.2 Compromise from the perspective of philosophy

From the philosophical perspective, compromise is a good condition for dyadic firms for resolving a conflict, often leading to the end of the conflict (Day, 1989) and producing a well-built condition of the dyadic relationship. Day (1989) argues that compromise is a prudential consideration between firms, because it is in their interest that the conflict be resolved. The traditional view of philosophy indicates that compromise can be a noun, as our definition, or a verb emphasizing that a focal party lets its trading partner make a compromise decision that puts the trading partner at risk. In this study, we restrict our notion of compromise to a noun. It implies that we exclude compromise being a power-related concept or construct. Further, compromise necessarily involves mutual or bilateral rather than unilateral concessions even though the concessions may be unconscious and can be in different forms. This implies that firms may lose their distinctiveness in order to merge different elements and reach compromised outcomes (Day, 1989; Saraf et al., 2007), i.e., the dyadic firms expect to gain more rewards from compromise through losing something they have (Day, 1989). These notions suggest that concession is a kind of relation-specific investments (Dyer & Singh, 1998). Thus, compromise enables idiosyncratic interfirm linkages that are sources of relational rents and competitive advantage from the relational view (Dyer & Singh, 1998).

### 3.3 The relational view

Compromise, which can temper conflict, is reflective of relational behaviour (Gundlach, Achrol, & Mentzer, 1995). From the relational view, the outcome of compromise is similar to the concept of relationship-specific intangible assets (Subramani & Venkatraman, 2003) and informal self-enforcing agreements (Dyer & Singh, 1998). Relationship-specific intangible assets have many forms, such as learning-by-doing, particularistic experience and relationship-specific organizational knowledge (Subramani & Venkatraman, 2003). Thus, compromise, created by investing in a series of negotiations and concessions, is specialized in conjunction of a pair of dyadic firms. Through these negotiations and concessions procedures, firms learn know-how and know-what of trading partners (Kogut & Zander, 1992). With a compromise reached, firms conceive a mutually acceptable settlement on operating procedures for efficient task execution and understand trading partners’ subtleties, helping effective actions in the future (Kogut & Zander, 1992). Thus, compromises as relationship-specific intangible assets are particularly resided in a specific dyadic relationship. Compromises created by the dyad cannot be adapted to other relationships, at least easily.

Informal self-enforcing agreements emphasize that interfirm governance relies on trust or reputation. Under self-enforcing agreements, trading partners are more likely and willingly to engage in value chain activities because they have credible assurances that they will be rewarded with such engagement (Dyer & Singh, 1998). Compromise is a kind of informal self-enforcing agreement because all concessions are freely and willingly made between firms as they expect to gain rewards from reaching compromise. Such self-enforcing effect is inherently based on long-term trust and commitment. In this paper, we focus on the dimensions and outcomes of compromise rather than the concession procedures of compromise. Based on the discussion above, we propose that compromise as a relational precondition will facilitate IOS integration, as further explained in the following section.

### 4 RESEARCH MODEL AND HYPOTHESES

Based on prior studies, we have identified that interfirm process and technology configuration are two major problems needed to be resolved in order to implement IOS integration successfully (Chatfield & Yetton, 2000; Kauremaa et al., 2010; Kumar & van Dissel, 1996; Lu et al., 2006; Rodon & Sese, 2010; Venkatraman, 1994). Accordingly, we propose that interfirm process compromise and
technology compromise are critical for achieving IOS integration effectively. The research model is presented in Figure 1, and the specific hypotheses are discussed below.

![Research Model Diagram]

**Figure 1. Research model**

### 4.1 Interfirm process compromise

Interfirm process compromise captures the extent to which dyadic firms realize a mutually acceptable interfirm processes in which each firm makes reciprocal concessions. Mutually acceptable interfirm processes are an outcome of dyadic firms’ joint realization on common interfirm operational processes through concessions or potential concessions that reflect the firms’ goodwill in cooperation. Interfirm operational processes include procurement, payment, shipment and quality control, inventory management, planning and forecasting, and return. Before implementing IOS integration, dyadic firms need to mutually align processes and to expose compatible business behaviours (Grover & Saeed, 2007). Both internal business processes and internal information systems of the dyadic firms must be redesigned or adjusted to achieve smooth coordination (Chatfield & Yetton, 2000; Walton & Gupta, 1999). However, as discussed above, achieving interfirm process choreography is not a simple matter due to the great variety of business requirements reflecting each other’s needs and constraints. Business processes are reflective of firms’ extant interests, values, and practices and are difficult to change because changes may harm their interests or internal stakeholders (Rodon & Sese, 2010) and thus usually cause conflicts between firms (Kauremaa et al., 2010; Lu et al., 2006). Accordingly, most firms, in practices, tend to avoid internal restructuring, leaving inefficient processes or ignoring overall interfirm dependence across processes (Chatfield & Yetton, 2000). It follows that a firm’s unwillingness to reengineer its processes is a barrier to implementing IOS integration and capturing the benefits of IOS integration. Persisting with well-understood and proven practices or pre-established organizational routines leads dyadic firms to lower levels of information sharing through IT (Bensaou & Venkatraman, 1995). Firms not only frequently disagree on conflicts, but their resolution often is also adversarial. These phenomena represent higher degrees of routine rigidity. In order to avoid falling into dissolution, dyadic firm have to exert mutual efforts to integrate and manage interfirm processes for establishing smooth coordination (Ramamurthy et al., 1999; Venkatraman, 1994; Walton & Gupta, 1999). Many negotiations and concessions inevitably have to be made for resolving process conflicts and to obtain the desired benefits (Lu et al., 2006). Therefore, interfirm process compromise as bilateral governance helps dyadic firms jointly develop the processes directed toward smooth interfirm coordination for practicing IOS integration (Heide, 1994).

Interfirm process compromise as an initial structure of smooth coordination puts the dyadic firms into a more readiness state and generates greater intention for them to implement IOS integration. The relational view suggests that relationship-specific intangible assets deliver better value in the context of specific dyadic relationship than in alternative contexts (Dyer & Singh, 1998). Realized interfirm process compromise is like relationship-intangible assets. Dyadic firm participating jointly in the pilot implementation of IOS integration and working to develop common processes will help them to a much closer relationship (Redondo et al., 2009). Because they have to sit down and clarify each other’s processes, dyadic firms can understand each other’s needs and constraints better. They then will be more willing to make concessions and reach smooth interfirm processes. This knowledge is
difficult to be adopted in other trading partners. Thus, when two firms realize higher levels of interfirm process compromise, they will have greater levels of mutual interest in working with each other in the future and gaining rewards from the integration. Further, interfirm process compromise as a self-enforcing agreement reduces adaptation costs and creates superior incentives for value co-creation initiatives (Dyer & Singh, 1998). Past studies suggest that IOS integration enables process changes (Saraf et al., 2007), but it may also incur risks if the firms fail to plan interfirm operational processes properly (Riggins & Mukhopadhyay, 1994). Under such circumstances, firms will inevitably incur more costs to safeguard IOS integration. Interfirm process compromise, based on trust and commitment, can reduce future adaptation costs caused by firms that are hesitant or unwilling to invest in changing operational processes (Riggins & Mukhopadhyay, 1994). Further, in the case study by Damagaard and Truex (2000), an operations manager explained that “different companies have different operational procedures. It is impossible to match all these needs. Everybody should be more flexible and seek to compromise more.” Thus, interfirm process compromise enables firms to alleviate the problem of coordinated process changes, thereby facilitating IOS integration.

Hypothesis 1: Interfirm process compromise is positively associated with IOS integration.

4.2 Technology compromise

Technology compromise refers to the extent to which dyadic firms realize mutually acceptable technology configurations in which each firm makes reciprocal concessions. IOS integration essentially implicates a variety of technology problems caused by the conflicts of networks, data, and applications (Mouzakis, Sourouni, & Askounis, 2009). Network problems are caused by unreliable, slow, and insecure network connections. Although Internet-related technology has become more mature, network problems still disturb companies. Data problems are comprised of inconsistencies of data representation format and data semantics (Mouzakis et al., 2009). Application problems mean that dyadic firms’ applications are unable to access each other’s memory, data, or services. When developing IOS integration, dyadic firms must face the above technology problems (Chong & Ooi, 2008; Kauremaa et al., 2010; Venkatraman, 1994). Information systems in different firms usually follow different configurations and are incompatible with trading partners’ internal technology configurations (Premkumar et al., 1994; Ramamurthy et al., 1999). Therefore, major software modifications or developments in order to connect applications and database are inevitably needed. These required modifications or developments increase the difficulties, conflicts, and adoption costs. Partners thus have to negotiate over detailed technology issues caused by these conflicting technology configurations (Zhu, Kraemer, Gurbasani, & Xu, 2006). It is then necessary for firms to make concessions on selecting standards, modifying internal systems and possibly developing new applications or middleware, and then reaching compromised solutions whenever possible in order to satisfy the precondition needed for greater IOS integration (Kauremaa et al., 2010; Ramamurthy et al., 1999; Zhu et al., 2006). Moreover, technology compromise may more be fundamental than interfirm process compromise because technology problems are the last step before a high degree of IOS integration can be realized.

Firms intended to be integrated with IOS then have to develop agreed technology configurations of interfaces and protocols for data exchange to maintain the integrity and functioning of the IOS. During a series of negotiations and concessions on these technology issues, as information-sharing routines (Dyer & Singh, 1998), the firms can understand each other’s technology problems and constraints (Kogut & Zander, 1992), allowing the transfer, recombination, or creation of specialized technology knowledge (Dyer & Singh, 1998). Such understanding and knowledge, potentially creating relational rents for the firms (Dyer & Singh, 1998), is sticky and thus not amenable to transfer to other relationships (Von Hippel, 1994). This knowledge allows the firms to tackle technology equivocality that usually causes misinterpretations and misunderstandings and is useful in establishing a common technology configuration for efficient interconnections. Thus, technology compromise as well-built technology know-how and know-what is critical for building stable and reliable technology linkages that enable IOS integration (Kumar & van Dissel, 1996). Although open standards, such as RosettaNet that provides ex ante rigid standards, have become popular in recent years, certain technical changes and adjustments are still inevitable and evolving for integrating
information systems between firms (Damsgaard & Truex, 2000). Past studies also emphasize that
technical compatibility plays a critical role in IOS integration (Ramanurthy et al., 1999). We,
therefore, maintain that technology compromise provides a needed precondition for resolving the
technology problems when implementing IOS integration.

Hypothesis 2: Technology compromise is positively associated with IOS integration.

4.3 Control variables

Previous studies have found some variables that affect IOS integration. Organizational and relational
characteristics as the basic lenses drive our selections of the control variables. We selected frequency
of purchasing and purchasing volume per year as the two relational characteristics. These two
variables represent important aspects of the transaction that usually implies the degrees of close
relationship between dyadic firms and can significantly influence IOS integration. Further, firm size is
also included in our model because larger firms may have greater resources, capabilities, and intention
to deploy IOS integration (Grover & Saeed, 2007).

5 RESEARCH METHODOLOGY

5.1 Measurement

We operationalized the constructs using multi-item reflective measures with a seven-point scale.
Table 1 shows the instrument. We operationalized IOS integration as the degree to which immediately
accessing each other’s databases, interconnection of each other’s applications, and data syntactic and
semantic integration characterize a focal firm’s IOS integration with its key supplier. Those three
characteristics reflect tighter coupling of dyadic information systems. A number of prior studies
helped us develop the ten-item reflective scale, as shown in Table 1.

We use the literature on negotiation strategies as the basis for developing compromise measurement
items corresponding to specific compromises – interfirm processes and technologies. We
operationalized interfirm process compromise and technology compromise based on Ganesan (1993)
by assessing the extent to which the dyadic firms realize mutually acceptable solutions of interfirm
processes and technology configurations in which each firm makes reciprocal concessions. We
modify the measures of Ganesan (1993), which emphasize on the intention to adopt compromise
strategy rather than on the outcome of compromise. For interfirm process compromise, we list the
main interfirm processes based on SCOR and UBL (Universal Business Language) model in our
questionnaires, and the respondents were asked to rate the degree to which mutually acceptable
solutions of interfirm processes have been reached with their chosen major supplier wherein both
firms make reciprocal concessions. Similar approach is adopted in assessing technology compromise.
We list the important technology configurations for IOS integration in the questionnaire. These
technology configurations come from studies that discuss technology issues of system integration,
including Giachetti (2004), Mouzakitis et al. (2009), and Puschmann and Alt (2005).

5.2 Sample and data collection

A cross-sectional and matched-pair mail survey of purchasing managers and IS executives was
administered for collecting data from selected large and medium-sized manufacturing firms in
Taiwan. A draft survey was developed largely based on measures that were identified in the literature
as suitable for the current study. After compiling an English-language version of the questionnaire,
the survey items were first translated into Chinese by a bilingual researcher. The survey items were
verified and refined for translation accuracy by an MIS professor and a senior doctoral student. The
Chinese version of the draft was then pretested with 6 senior managers (including CEO, senior
business manager, procurement manager, and IS executive) for face and content validity, resulting in
modification of the wording of some survey items. We selected Top 1000 manufacturing firms from
the Year 2012 directory of the Top 5000 Largest Firms in Taiwan, published by China Credit Information Services Ltd. Survey packages were mailed to the purchasing managers of each target firm with a request that the recipient completed Part A related to interfirm process compromise, wrote down the supplier name he referred on Part B, and distributed Part B to the suitable IS executive to provide information about IOS integration and technology compromise. Part A and B must refer to a same supplier because all of our constructs are relation-specific. Fifty five surveys were returned in total, with 44 having completed the data and available for subsequent analysis, yielding an effective response rate of 4.4%. Although the response rate is not high, it is acceptable to examine our model using partial least squares (PLS) according to Chin’s rule of ten (Chin, Marcolin, & Newsted, 2003). Table 2 exhibits the characteristics of the sample. Harman’s one factor test is used to examine the common method bias, showing no significant common method bias in the sample.

<table>
<thead>
<tr>
<th>Scale indicators</th>
<th>References</th>
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<tbody>
<tr>
<td><strong>IOS integration</strong></td>
<td></td>
</tr>
<tr>
<td>Our company shares databases</td>
<td>Saraf et al. (2007)</td>
</tr>
<tr>
<td>with each other.</td>
<td>Rai and Tang (2010)</td>
</tr>
<tr>
<td>We have successfully integrated relevant applications of our system with this supplier’s applications.</td>
<td>Grover and Saeed (2007)</td>
</tr>
<tr>
<td>Our applications work seamlessly with this supplier’s applications.</td>
<td>Saeed, Malhotra, and</td>
</tr>
<tr>
<td>Our applications can share real time information with this supplier’s applications.</td>
<td>Grover (2011)</td>
</tr>
<tr>
<td>We have synchronized data formats and standards with this supplier.</td>
<td>Rai et al. (2006)</td>
</tr>
<tr>
<td>The data formats and standards used in the systems of our firm and this supplier are based on a common standard.</td>
<td></td>
</tr>
<tr>
<td>Definitions of key data elements (e.g., order and part numbers) are common between ours and this supplier’s system.</td>
<td></td>
</tr>
<tr>
<td><strong>Dropped item:</strong> Data are entered only once to be retrieved by this supplier’s system.</td>
<td></td>
</tr>
<tr>
<td><strong>Dropped item:</strong> Our system can access data from this supplier’s system.</td>
<td></td>
</tr>
<tr>
<td><strong>Dropped item:</strong> Our system can aggregate relevant information from this supplier’s databases.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interfirm process compromise</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interfirm processes between our company and this supplier are mutually acceptable solutions rather than totally following our ways or their ways.</td>
<td>Ganesan (1993)</td>
</tr>
<tr>
<td>Both our company and this supplier have willingly made concessions on interfirm process issues rather than persist in self-ways.</td>
<td>SupplyChainCouncil (2012)</td>
</tr>
<tr>
<td>Interfirm processes between our company and this supplier have been tailored to meet both parties’ operation characteristics.</td>
<td>Bosak, McGrath, and Holman (2006)</td>
</tr>
<tr>
<td>Interfirm processes between our company and this supplier meet both parties’ organizational needs and constraints.</td>
<td></td>
</tr>
<tr>
<td>Overall, interfirm processes between our company and this supplier are a compromise solution.</td>
<td></td>
</tr>
<tr>
<td><strong>Dropped item:</strong> Interfirm processes between our company and this supplier are fair combinations of both parties’ gains and losses.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Technology compromise</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology configurations connecting our system and this supplier’s system are mutually acceptable solutions rather than totally following our ways or their ways.</td>
<td>Ganesan (1993)</td>
</tr>
<tr>
<td>Both our company and this supplier willingly make concessions on technology issues rather than persist in self-ways.</td>
<td>Giachetti (2004)</td>
</tr>
<tr>
<td>Technology configurations connecting our system and this supplier’s system have been tailored to meet both parties’ internal system characteristics.</td>
<td>Mouzakitis et al. (2009)</td>
</tr>
<tr>
<td>Technology configurations connecting our system and this supplier’s system meet both parties’ system needs and constraints.</td>
<td>Puschmann and Alt (2005)</td>
</tr>
<tr>
<td>Overall, technology configurations connecting our system and this supplier’s system are a compromise solution.</td>
<td></td>
</tr>
<tr>
<td><strong>Dropped item:</strong> Technology configurations connecting our system and this supplier’s system fairly combine both parties’ gains and losses.</td>
<td></td>
</tr>
</tbody>
</table>

*Table 1. Scale indicators and literature sources*
<table>
<thead>
<tr>
<th>MIS title</th>
<th>%</th>
<th>Procurement title</th>
<th>%</th>
<th>Industry</th>
<th>%</th>
<th>Number of employees</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director</td>
<td>6.8</td>
<td>Director of purchasing</td>
<td>15.9</td>
<td>Automobile</td>
<td>6.8</td>
<td>1-250</td>
<td>36.4</td>
</tr>
<tr>
<td>Manager</td>
<td>34.1</td>
<td>Manager</td>
<td>45.5</td>
<td>Chemical</td>
<td>13.6</td>
<td>251-500</td>
<td>18.2</td>
</tr>
<tr>
<td>MIS manager</td>
<td>13.6</td>
<td>Purchasing manager</td>
<td>15.9</td>
<td>Computer and electronics</td>
<td>31.8</td>
<td>501-1,000</td>
<td>13.6</td>
</tr>
<tr>
<td>MIS engineer</td>
<td>15.9</td>
<td>Purchasing team leader</td>
<td>4.5</td>
<td>Food</td>
<td>4.5</td>
<td>1,001-2,000</td>
<td>15.9</td>
</tr>
<tr>
<td>Others</td>
<td>20.5</td>
<td>Other position</td>
<td>13.6</td>
<td>Machine and tool</td>
<td>6.8</td>
<td>&gt;2,000</td>
<td>15.9</td>
</tr>
<tr>
<td>Missing</td>
<td>9.1</td>
<td>Missing</td>
<td>4.5</td>
<td>Mental and materials</td>
<td>22.7</td>
<td>Textile</td>
<td>6.8</td>
</tr>
<tr>
<td>Others</td>
<td>6.8</td>
<td></td>
<td></td>
<td>Others</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Profile of the respondents (N=44)

6 RESULTS

6.1 Measurement model

The mean, range, and standard deviation for each construct are reported in Table 3. Path loadings for all items are significant at 1% level. The composite reliability (CR) estimates are above 0.9 for all constructs, indicating good internal consistency. The constructs were also assessed for reliability by using Cronbach’s alpha. All the alpha values are above 0.9 for the constructs. We checked normal distribution using Q-Q plot of construct scores, indicating insignificant deviation from a normal distribution. The results from the PLS analysis support the convergent and discriminant validity of our measures. Discriminant validity is established when the square root of the average variance extracted (AVE) by each construct is larger than the inter-construct correlations. We note that all the cross-loadings for the individual items are less than their construct-specific loadings, supporting the convergent and discriminant validity of our measures.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Mean</th>
<th>Std.</th>
<th>Cronbach’s α</th>
<th>CR.</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. IOS integration</td>
<td>3.98</td>
<td>2.04</td>
<td>0.95</td>
<td>0.96</td>
<td>0.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Interfirm process compromise</td>
<td>5.15</td>
<td>1.34</td>
<td>0.97</td>
<td>0.98</td>
<td>0.19</td>
<td>0.94</td>
<td></td>
</tr>
<tr>
<td>3. Technology compromise</td>
<td>5.07</td>
<td>1.61</td>
<td>0.95</td>
<td>0.96</td>
<td>0.56</td>
<td>0.4</td>
<td>0.91</td>
</tr>
</tbody>
</table>

Note: Square roots of average variance extracted are shown on the diagonal.

Table 3. Descriptive statistics, Cronbach’s α reliability, and composite reliability (N=44)

Figure 2. Results for the PLS structural model
Note: * p<0.05; ** p<0.01; () exploratory results
6.2 Structural model

To assess the significance of the path coefficients in the structural model, SmartPLS was applied to generate 5000 samples using a bootstrapping technique (Hair, Ringle, & Sarstedt, 2011). The full model has an $R^2$ of 32.9% for IOS integration. That all the $Q^2$ values are larger than zero indicates that the exogenous constructs have predictive relevance for the endogenous construct under consideration. However, the data fail to support H1, showing insignificant relationship between interfirm process compromise and IOS integration. The results corroborate H2 ($p<0.01$), implying that technology compromise is positively related to IOS integration. All control variables are insignificant. The results from the model testing are shown in Figure 2.

7 DISCUSSION AND CONCLUSIONS

IOS integration has been proposed as a desirable state in the context of buyer-supplier relationships. This study builds a new approach to explaining IOS integration by examining how compromised results can shape IOS integration in a dyadic context. The model is based on the perspective of relational view to develop compromise constructs and hypotheses, theorizing the effects of compromises on IOS integration. Our results are discussed below.

7.1 Compromise effects

Surprisingly, interfirm process compromise is not positively associated with IOS integration. Our results fail to support our hypothesis (H1) and prior study of Grover and Saeed (2007) who suggest that IOS integration requires dyadic firms to align processes and must have well-built interfirm processes to be compatible with the business behaviours of the firms. In order to get further insights, we explore the relationship between interfirm process compromise and technology compromise, showing a significant relationship ($p<0.01$). Accordingly, one plausible reason is that interfirm process compromise is likely to promote IOS integration indirectly through technology compromise. In general, interfirm process problems are usually discussed before technology issues because it is processes that drive operations. Without first adjusting each other’s processes and finding a mutual acceptable solution for the interfirm processes, technology will have little use. When the firms can realize higher levels of interfirm process compromise, they may perceive a greater level of mutual interest in working with each other and enhance process integration further. Interfirm process compromise may create more suitable circumstance and experience for the firms discussing technology problems, reaching technology compromise, and then facilitating IOS integration. Moreover, reached interfirm process compromise, reflecting mutually acceptable and smooth operational processes, is able to bring initial benefits for dyadic firms, such as operational efficiency and excellence. IOS integration, therefore, becomes a selected resolution to further improve their operations. They may choose not to invest resources in facilitating higher levels of IOS integration but integrate their IOS in minimum way, which satisfies their fundamental needs of daily operations. When dyadic firms decide to implement higher levels of IOS integration, they can go through technology issues and realize technology compromise. Consequently, interfirm process compromise aligns with technology compromise to facilitate integrated IOS indirectly.

We found that the compromise on technology problems strongly facilitates IOS integration (H2). Our results support our arguments and verify that technology compromise is final destination before implementing IOS integration, which inevitably implicates technology problems. Most prior studies focus on how to resolve technology problems including network, data, and applications with technical perspective. Our arguments propose that firms need to jointly resolve these problems with their trading partners rather than to force them enrol specific technology configurations. Thus, IT/IS personnel of the firms and their trading partners need to (re)negotiate and to reach compromises during building up database sharing, application connections, and data syntactic and semantic integration. Failing to build smooth technology configurations would lead the firms to implement
lower levels of IOS integration. Our results therefore suggest that having appropriate technology compromises is critical for implementing IOS integration.

7.2 Limitations

This study has several limitations. First, although there are several benefits in using IOS integration in the practice, this study does not undertake investigation of its impact on measures of firm or supply chain performance. Our focus is to find the antecedents of IOS integration. Future research may engage in explore different aspects of benefits of IOS integration. Second, the response rate of the survey appears low level. We consider that we conduct a multiple respondent survey, which can reduce common method bias but is likely to get trouble with respondents. That may a main reason of low response rate. Even though the possibility of nonresponse bias was checked and ruled out statistically, the representativeness of the sample, and thus the generalizability of the results, could still be limited. Third, the cross-sectional nature of the study only provides us with evidence for association among the study variables. However, the theoretical foundations employed to support the hypotheses provide justification for the path model presented in this study. Finally, the respondents were asked to select a major supplier and it was left to the respondent to decide which supplier they selected. Assuming that the choice of the relationship will be randomly distributed across the sample, it may have minimal effects on the results.

7.3 Contributions

This study, from the compromise perspective and the relational view, contributes to the literature by arguing the importance of interfirm process compromise and technology compromise on IOS integration. This approach emphasizes that typically it is compromise rather consensus that is reached for joint effort between firms. Each firm has to make sacrifice first in order to obtain a greater reward later through the relational rents created by their collaboration. Thus, when firms attempt to implement IOS integration, it should pay sufficient attention to how to reach the needed compromises with their trading partners on the issues related to interfirm processes and technologies through mutual concessions rather than through coercion or unilateral concession. Finally, our results also remind firms and managers that IOS adoption does not automatically bring about IOS integration. Realize a high degree of IOS integration is likely to be a long journey inevitably involving a variety of conflicts, negotiations, concessions, and compromises between trading partners.
References


